

Amendments to the Specification

The paragraph starting at page 1, line 19 and ending at line 24 has been amended as follows.

Inkjet printers are mostly known as a printing ~~device~~ devices used in printers, copying machines, or the like. Particularly, ~~inkjet printers, which~~ printers that employ a method utilizing heat energy as ink discharging energy and discharge ink by bubbles generated by the heat ~~energy~~, energy have recently come into general use.

The paragraph starting at page 2, line 9 and ending at line 20 has been amended as follows.

For example, one inkjet print head can realize both high-speed printing and high-quality printing by the following functions. That is, in the high-speed mode, high-speed printing with a low printing resolution is realized by increasing the amount of ink droplets discharged from respective discharge orifices so as to enlarge the size of a dot that can be printed by one ink droplet. ~~while, in~~ In the high-quality mode, printing is realized at a high printing resolution by reducing the amount of ink droplets discharged from respective discharge orifices so as to reduce the size of a dot that can be printed by one ink droplet.

The paragraph starting at page 2, line 25 and ending at page 3, line 2 has been amended as follows.

Japanese ~~patent~~ Patent Application Laid-Open No. 09-286108 discloses an inkjet printhead to meet the demands. It discloses a technique for achieving a high tonality by providing a plurality of heaters in one nozzle to change the size of a printing dot.

The paragraph starting at page 4, line 24 and ending at page 5, line 1 has been amended as follows.

The select signal 305 in Fig. 27 is inputted to the input terminals 1 to n (~~Select1~~ Select 1 - n) that are commonly provided to the groups S(1) to S(m). By the select signal 305, heaters subjected to heating in the respective groups S(1) to S(m) can be selected.

The paragraph starting at page 10, line 21 and ending at page 11, line 11 has been amended as follows.

In order to attain the object, an inkjet printhead according to the first aspect of the present invention has the following configuration. More specifically, the inkjet printhead has an array of printing elements, where first and second printing elements which discharge relatively different amounts of ink are arranged on the same array in a

predetermined direction, and the print head comprises: storage means for sequentially storing print data that is serially inputted; holding means for holding the print data stored in the storage means; and a driving control circuit for driving respective printing elements in accordance with a selection signal indicative of which of the first or second printing element is to be driven, the print data held by the holding means, and a driving signal indicative of a driving period, wherein the print data is inputted to either the first or second printing element.

The paragraph starting at page 11, line 12 and ending at page 12, line 4 has been amended as follows.

Furthermore, in order to attain the foregoing object, a driving method of an inkjet printhead according to the first aspect of the present invention has the following steps. More specifically, the driving method of an inkjet printhead having an array of printing elements, where first and second printing elements which discharge relatively different amounts of ink are arranged on the same array in a predetermined direction, ~~the method~~ comprises: a data input step of serially inputting print data for the first or second printing element; a storing step of sequentially storing the inputted print data; a holding step of holding the stored print data; a selecting step of inputting a selection signal, indicative of which of the first or second printing element is to be driven; a driving designation step of inputting a driving signal indicative of a driving period; and a driving

control step of driving respective printing elements in accordance with the print data held, the selection signal, and the driving signal.

The paragraph starting at page 12, line 5 and ending at line 19 has been amended as follows.

Furthermore, the foregoing object is also attained by an inkjet printhead according to the second aspect of the present invention. More specifically, the inkjet printhead has first and second printing elements which discharge relatively different amounts of ink, and comprises: storage means for sequentially storing print data that is serially inputted; holding means for holding the print data stored in the storage means; a driving control circuit for driving respective printing elements in accordance with a selection signal indicative of which of the first or second printing element is to be driven, the print data held by the holding means, and a driving signal indicative of a driving period; and a signal line, to which the print data and the selection signal are serially inputted.

The paragraph starting at page 12, line 20 and ending at page 13, line 9 has been amended as follows.

Furthermore, the foregoing object is also attained by a driving method of an inkjet printhead according to the second aspect of the present invention. More specifically, the driving method of an inkjet printhead having first and second printing elements which

discharge relatively different amounts of ink, ~~the method~~ comprises: a storing step of sequentially storing print data that is serially inputted; a holding step of holding the print data stored; an input step of inputting a selection signal indicative of which of the first or second printing element is to be driven; and a driving control step of driving respective printing elements in accordance with the print data held, and a driving signal indicative of a driving period, wherein the print data and the selection signal are serially inputted from a same signal line.

The paragraph starting at page 13, line 25 and ending at page 14, line 9 has been amended as follows.

By virtue of this configuration, even in a case where the printhead is constructed with first and second printing elements which ~~discharges~~ discharge relatively different amounts of ink and are arranged on the same array, for instance, assuming that the number of the first printing elements and the number of the second printing elements are the same, the number of print data inputted at once becomes half the number of all printing elements. Therefore, the amount of data stored and held is cut down to half the number of printing elements. Also, printing performed by the first or second printing element can be realized with simple driving control.

The paragraph starting at page 16, line 17 and ending at page 17, line 17 has been amended as follows.

Furthermore, the foregoing object is also attained by a substrate for an inkjet printhead according to the present invention. More specifically, as to the substrate for an inkjet printhead which discharges ink by utilizing heat energy generated by a plurality of heaters incorporated in the substrate, the heaters divided into m ~~numbers of~~ groups each having n ~~numbers of~~ heaters, the substrate comprises: m x n ~~numbers of~~ driving circuits, provided in correspondence with each of the heaters, for driving each of the heaters; a selection data transfer circuit for separating input data into image data for driving m ~~numbers of~~ heaters and a selection signal for selecting m ~~numbers of~~ groups and n ~~numbers of~~ heaters constituting each group; a holding circuit for inputting the image data for driving the m ~~numbers of~~ heaters, received from the selection data transfer circuit, to supply the image data in units of each group to the heaters constituting each of the m ~~numbers of~~ groups; and a selection data holding circuit for inputting the selection signal for selecting the m ~~numbers of~~ groups and n ~~numbers of~~ heaters constituting each group, received from the selection data transfer circuit, to select the heaters to be driven via the driving circuits, wherein the n ~~numbers of~~ heaters are arranged opposite to each other in a zigzag manner with an ink supplying orifice ~~on~~ at the center, and the selection data holding circuit selects one of the n ~~numbers of~~ heaters constituting each group.

The paragraph starting at page 17, line 18 and ending at line 23 has been amended as follows.

The ~~n numbers of~~ heaters may have an equal size, and amounts of ink discharged from the heaters by heat energy generated may be equal, or the ~~n number of~~ heaters may have different sizes, and amounts of ink discharged from the heaters by heat energy generated may be different.

The paragraph starting at page 21, line 16 and ending at line 23 has been amended as follows.

In this specification, “print” ~~is~~ means not only to form significant information such as characters and graphics, but also to form, e.g., images, figures, and patterns on printing media in a broad sense, regardless of whether the information formed is significant or insignificant or whether the information formed is visualized so that a human can visually perceive it, or to process printing media.

The paragraph starting at page 24, line 23 and ending at page 25, line 5 has been amended as follows.

As a preliminary example, one of the illustrative printheads adopting the method discharging ink by utilizing heat energy, a so-called side-shooter inkjet printhead, which discharges an ink droplet upward in the vertical direction of the surface where heaters ~~generating~~ generate the heat energy, will be described. An inkjet printhead of this

type generally supplies ink from the backside of the substrate, where the heaters are arranged, and discharges the ink through an ink supplying orifice penetrating the substrate.

The paragraph starting at page 26, line 21 and ending at page 27, line 6 has been amended as follows.

Fig. 2 shows an array of discharge orifices of the printhead according to the first embodiment. To discharge two different types of ink droplets: large and small ink droplets, a discharge orifice (large discharge orifice) 20 which discharges a droplet having a large amount of ink ~~droplet~~ and a discharge orifice (small discharge orifice) 21 which discharges a droplet having a small amount of ink ~~droplet~~ are alternately arranged on a line at intervals of 1200 dpi. There are 32 discharge orifices, which are referred to as 0seg, 1seg, ..., 31seg from the top. The amount of ink discharge is about 5 pl for the discharge orifice 20, and about 2 pl for the discharge orifice 21.

The paragraph starting at page 30, line 3 and ending at line 7 has been amended as follows.

Although the above description is provided ~~on~~ as to the case of driving 16 odd-number seg (heat drivers), if the select signal 30 is L, 16 even-number seg (heat drivers) are driven in accordance with the print data in ~~the~~ a similar manner to the above description.

The paragraph starting at page 31, line 8 and ending at line 20 has been amended as follows.

The printhead according to the second embodiment also has 32 discharge orifices having ~~the~~ a similar array as that of the first embodiment. The configuration of the driving circuit shown in Fig. 8 is substantially the same as that of the first embodiment shown in Fig. 3. The selector 86, 2-to-4 decoder 87, AND gates 810, and heat drivers 811 in Fig. 8 respectively correspond to the selector 36, 2-to-4 decoder 37, AND gates 310, and heat drivers 311 in Fig. 3. The input/output characteristics of the 2-to-4 decoder, the input/output characteristics of the selector, and driving condition of each seg (heat drivers) are the same as that of the first embodiment.

The paragraph starting at page 33, line 10 and ending at line 22 has been amended as follows.

The printhead according to the third embodiment also has 32 discharge orifices having ~~the~~ a similar array as that of the first and second embodiments. The configuration of the driving circuit shown in Fig. 10 is substantially the same as that of the second embodiment shown in Fig. 8. The 2-to-4 decoder 107, AND gates 1010, and heat drivers 1011 in Fig. 10 respectively correspond to the 2-to-4 decoder 87, AND gates 810, and heat drivers 811 in Fig. 8. The input/output characteristics of the 2-to-4 decoder, the

input/output characteristics of the selector, and driving condition of each seg (heat drivers) are the same as that of the first embodiment.

The paragraph starting at page 35, line 14 and ending at page 36, line 1 has been amended as follows.

Fig. 12 shows an array of discharge orifices of a printhead according to the fourth embodiment. In this embodiment, in order to discharge three types of ink droplets: large, medium, and small ink droplets, a discharge orifice 1200 which discharges a droplet having a large amount of ink, ~~droplet~~, a discharge orifice 1201 which discharges a droplet having a medium amount of ink, ~~droplet~~, and a discharge orifice 1202 which discharges a droplet having a small amount of ink ~~droplet~~ are sequentially arranged at intervals of 1200 dpi. There are 48 discharge orifices, which are referred to as 0seg, 1seg, ..., 47seg from the top. The amount of ink discharge is about 10 pl for the discharge orifice 1200, about 5 pl for the discharge orifice 1201, and about 2 pl for the discharge orifice 1202.

The paragraph starting at page 38, line 3 and ending at line 13 has been amended as follows.

Among the four arrays of discharge orifices, arrays of discharge orifices for cyan, magenta, and yellow have ~~the~~ a similar configuration as that of the first embodiment shown in Fig. 2. More specifically, discharge orifices for discharging two types (large and

small) of ink droplets are alternately arranged at intervals of 1200 dpi. Meanwhile, with respect to an array of discharge orifices for black, 16 discharge orifices 1601, each discharging an ink droplet of 30 pl, are arranged at intervals of 600 dpi as shown in Fig. 16.

The paragraph starting at page 44, line 15 and ending at line 21 has been amended as follows.

The heaters A and B correspond to the heaters 302 and 303 shown in Fig. 20. 2(n) types of heaters A and B constitute one group of heaters, and m ~~numbers of~~ groups are provided. The driving circuit 407 and AND circuit are provided ~~to~~ for each of the heaters A and B. The driving circuit 407 drives the heater in accordance with an output of the AND circuit.

The paragraph starting at page 51, line 13 and ending at line 19 has been amended as follows.

Note that although the above-described embodiments have described an example of an inkjet printhead which performs printing by an inkjet printing method and a printer employing the inkjet printhead, the present invention is also applicable to a printhead using a printing method other than the inkjet printing method and a printer employing such inkjet printhead.

The paragraph starting at page 53, line 6 and ending at line 12 has been amended as follows.

By discharging the liquid (ink) through a discharge opening by growth and shrinkage of the bubble, at least one droplet is formed. If the driving signal is applied as a pulse signal, the growth and shrinkage of the bubble can be attained instantly and adequately to achieve discharge of the liquid (ink) with the particularly high response characteristics.

The paragraph starting at page 53, line 13 and ending at line 18 has been amended as follows.

As the pulse driving signal, signals disclosed in U.S. Patent Nos. 4,463,359 and 4,345,262 are suitable. Note further that excellent printing can be performed by using the conditions described in U.S. Patent No. 4,313,124, ~~of the invention~~, which relates to the temperature rise rate of the heat acting surface.